

Broadband Packet Wireless Access and Its Field Experiments

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Abstract

For future mobile communication systems beyond 3G systems, it is considered that radio access networks (RANs) with a short delay (i.e., low latency) and with affinity to IP-based core networks are desirable to provide rich high-rate services at low cost.

In the presentation, our views on the migration to broadband packet-based RANs in future cellular systems will be presented, and the considered requirements and targets of broadband packet wireless access for the systems beyond IMT-2000 will be discussed. In the proposed design concept, the focus is on broadband wireless access schemes that flexibly support both cellular systems with a multi-cell configuration and local areas such as isolated cells, very-small cell (hotspot) and indoor environments, from the standpoint of further reducing the RAN cost. To realize this concept, the proposed broadband packet wireless access based on Variable Spreading Factor (VSF)-Orthogonal Frequency and Code Division Multiplexing (OFCDM) in the downlink and Variable Spreading and Chip Repetition Factor (VSCRF)-CDMA in the uplink, will be discussed. In the proposed access schemes, one-cell frequency reuse in cellular environments is easily achieved by utilizing the spreading gain in the time and frequency domains, whereas the orthogonality in the time and frequency domains is fully utilized in local areas by decreasing the spreading factor values.

Evaluation results will also be presented on multiple-antenna transmission/reception techniques such as Multiple-Input Multiple-Output (MIMO) multiplexing, which is beneficial in enhancing frequency efficiency. Considering the application of the MIMO technique to an actual wireless system, a decoding scheme based on the Maximum Likelihood Detection (MLD) employing QR decomposition and the M-algorithm (QRM-MLD) for OFCDM MIMO multiplexing will be introduced aiming at the throughput of 1 Gbps assuming a 100-MHz bandwidth (i.e., frequency efficiency of 10 bits/sec/Hz). Then, the proposed techniques that further reduce the computational complexity will be given based on the QRM-MLD together with design consideration of a 1-Gbps transceiver that takes advantage of MIMO multiplexing.

Finally, the results of field experiments that were conducted in cellular environments with the cell radius of approximately 1 km at the average moving speed of 30 km/h will be presented to show the possibility of high-speed packet data service of more than 100 Mbps in future cellular systems.